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A Study of the Relationships Between Grade-Point Averages, Placement-Test Scores, Semester Hours Earned, and Area of Major Interest for the Group Who Entered The University of Kansas in the Fall of 1954

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and
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A Study of the Relationships Between Grade-Point Averages, Placement-Test Scores, Semester Hours Earned, and Area of Major Interest for the Group Who Entered The University of Kansas in the Fall of 1954

E. L. Barnhart* and Kenneth E. Anderson**

PART I

Purpose of the Study

Trends in Enrollments and in Admissions Policies in Colleges

The subject of increasing enrollments in public education has received widespread attention in newspapers, popular magazines, and educational journals during the past decade. The increases already extant at the elementary and secondary school levels were predicted with reasonable accuracy from census data based on the increased birth rate during and after World War II. Predictions were not difficult to make, particularly at the elementary level, where school attendance is compulsory, and the percentage of children attending private and parochial schools is known. At the high school level, the problem of prediction is complicated somewhat by changing economic conditions, early marriages, availability of employment, and other factors.

At the college level, the factors involved in prediction became even more complex. The basic statistic is still the birth rate for the years in which the present college-age group was born. As in the case of the high school, attendance will be affected somewhat by economic conditions, although the effect will not likely be the same at both levels, due to the difference in employability of the college-age group as compared with the high school-age group, and also due to the fact that the cost of attending college is borne in

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part by the individual student. Stated differently, enrollments in colleges and universities are influenced not only by the birth rate 18 to 21 years prior to the date in question, but also by the proportion of college-age youth attending colleges. Table 1 shows the changes in the size of the college-age group and in the percentage of this group attending college at ten-year intervals from 1870-1950, as well as for 1955. An examination of Table 1 reveals a startling increase in the percentage of the college-age group in attendance at college, particularly in recent years. Many observers of the educational scene believed that the post-World War II enrollment in terms of the proportion of the college-age group was artificially inflated by the numbers of veterans in attendance, and they expected that the percentage would decline as these veterans graduated. The 1955 data show that this was not true.

TABLE 1

Population and Resident College Enrollment In Continental United States, 1870-1955[1]

	Population		Resident College Enrollment*	
Year	U.S. Total	Ages 18-21	Number	Per cent of Group 18-21
1870	38,558,371	3,115,555	52,286	1.7
1880	50,155,783	4,253,027	115,817	2.7
1890	62,622,250	5,160,067	156,756	3.0
1900	75,994,575	5,930,765	237,592	4.0
1910	91,972,266	7,335,453	355,213	4.8
1920	105,710,620	7,343,793	597,880	8.1
1930	123,076,685	9,033,000	1,100,737	12.2
1940	131,669,275	9,753,537	1,494,203	15.3
1950	150,697,361	8,805,020	2,659,021	30.2
1955	165,271,000	8,577,000	2,755,000	32.1

* Includes students, regular session only, full-time and part-time, taking degree-credit courses on the main campus or branch campus of an institution of higher education and under the instructional staff of the institution. Excludes extension, correspondence, adult education, short course, and individual-lesson students. The number of full-time students is substantially smaller than the table figures indicate.

In discussing the problem of predicting future college enrollments, Axt says:

> At the time of the 1947 Commission report, there were 2.4 million students enrolled in American colleges and universities, of whom about 1 million were veterans. The Commission estimated that only 15 percent of the civilian college-age group (eighteen to twenty-one-year-olds) were enrolled in college.

[1] Educational Policies Commission. *Higher Education in a Decade of Decision.* National Education Association, Washington D.C., 1957, p. 22.

> Projecting prewar trends to 1960, the Zook Commission estimated that only 2.9 million persons would be enrolled in colleges and universites by 1960. This, they maintained, was not enough. Assuming that at least 49 percent of our population have the mental ability to complete 14 years of study and that 32 percent could complete an advanced liberal or professional education, the Zook Commission set a college enrollment goal of 4.6 million by 1960.[2]

Actually, by the fall of 1956, college enrollments had nearly reached 3 million, well above the 2.9 million predicted for 1960. The underestimate was not due to error in estimating the size of the college-age group because these data are readily available from the United States census reports. The error originated with the inability of the Commission to estimate the propensity of this group to attend college, as well as the ever-increasing demand for college graduates. Estimates of future college enrollments from other sources have varied somewhat, due to the factors already discussed, but the fact remains that even if the percentage of college-age youth attending college were to stabilize at the figure of 32, which is not likely, the increases in the college-age group that will continue to materialize will bring about enrollments of 5 million or more students in colleges and universities within a few years.

Arguments for and Against Selective Admission of College Freshmen

Selective admission of college freshmen is not new; it has long been practiced by many institutions of higher learning. The imminent prospect of numbers of students desiring admission to college exceeding the limitations of staff, budget, and physical facilities that will be available, however, has led many additional college and university administrators to at least consider the possibility of limiting admission on a selective basis. Reasonably convincing arguments can readily be advanced to support either side of the issue. Introducing a discussion in which he presents arguments from both viewpoints, Millett says:

> The proper admission policy for state-supported colleges and universities is not a simple problem. Perhaps the only answer is that which obtains in so many other phases of higher education in our country; namely, that there is no one answer.[3]

Continuing the discussion, he points out that in the states of Kansas, Montana, Nevada, and Ohio, unrestricted admission is practiced in the insti-

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[2] Richard G. Axt. "The Joseph Report—Toward a Federal Policy in Higher Education." *Educational Record,* 38 (October, 1957) 291-299.

[3] John D. Millett. "Restrictive Admission in State-Supported Higher Education." *Journal of Higher Education,* 27 (April, 1956) 175-178.

tutions of higher learning in accordance with statutory provisions. Unrestricted admission has been generally practiced in 13 additional states, while 31 states restrict admission to their state universities in accordance with standards fixed by their governing boards.

A number of arguments having at least face validity can be given in support of a policy and practice of restrictive admission to college. Millett summarizes these in the following paragraph:

> A restrictive admission policy on the part of state-supported institutions has a number of justifications. In the first place, the intellectual standards which should characterize higher education are emphasized when admission is a privilege to be earned, not a legal right to be claimed. In the second place, quality college performance is more readily maintained when the initial admission of students is on a quality basis. In the third place, restrictive admission avoids the economic wastefulness of providing facilities and personnel for students who are poor educational risks and will not complete college work.[4]

Arguments such as these seem particularly logical and appealing in times when college enrollments are expanding and the problems of obtaining adequate funds, facilities, and instructional staff to handle future enrollments seem almost insurmountable. Thompson approaches the problem from this point of view when he says:

> These, then, are the problems which face those responsible for educational planning in the years immediately ahead. We must decide whether or not to continue our present educational pattern of four years in a college or university followed, in general, by graduate or professional training. It must be recognized that if the decision is to do this, the economic burden will be far greater than any we have been called upon to bear thus far. It is, of course, conceivable that the decision will be to limit educational opportunity for all to the first two years beyond the secondary school. Some type of selection procedure may be instituted whereby only the most able are permitted to go on beyond certain levels in higher education, just as we now have limitations in the various professional schools. This is a major decision which must be made and made reasonably soon.[5]

Many writers take the position that too many young people of limited ability are now enrolled in our institutions of higher learning. They see in the impending flood of applications for admission to college an opportunity to weed out the unfit and to grant admission to the superior students only.

Many valid reasons for open admission to college can be advanced. First, perhaps, is the previously discussed fact that in several states legal provisions make mandatory the unrestricted admission of all graduates of high schools

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[4] *Ibid.*, p. 178.

[5] Ronald B. Thompson. "Rising Educational Needs." *College and University*, 29 (July, 1954) 556-563.

within the state. Referring again to Millett, we find that he presents several reasons for open admission as follows:

> An open admission policy is not without its justification, however. In the United States we believe in a fluid society. We believe also in the 'second chance.' Is the high-school student of poor record and even of poor test performance to be denied completely the opportunity to demonstrate his eagerness and ability to reform and to do satisfactory college work? Moreover, what about the individual instances where for one reason or another the high-school record and the test score simply fail to reveal the true ability of the prospective college student?[6]

Implied in the last statement of the preceding quotation is the lack of accuracy of any existing instrument for prediction of individual success in college. While many tests and records of performance have been demonstrated to have considerable relationship to group performance in college, individual forecasting is a different matter. An excellent illustration of the operation of this factor is given in the closing paragraph of Smith's study. It reads:

> It is also fair to repeat that if restrictions for admission had been applied through the use of the two tests used in this study, 208 graduates (out of 1134) of the Class of 1955 at the University of Kansas would not have been admitted as freshmen if the "cutting score" of the fiftieth percentile had been in operation. The loss to the state and nation would have been forty teachers, twenty-two engineers, five journalists, seven lawyers, seven doctors, seven pharmacists, and ninety-six graduates from the College of Liberal Arts and Sciences and the School of Business who majored in areas where the supply of trained manpower is in equally short supply.[7]

Natural Selection and Selective Retention

Even in the case of those institutions where no formal procedures of selective admission are in existence, certain natural processes of selection operate. Secondary school teachers, principals, and guidance workers undoubtedly influence students in reaching a decision to attend, or not to attend college. The related decision of just which college to attend is also likely to be influenced by parents, teachers, and administrators, and by college students and graduates, who have formed opinions relative to the level of ability required for success in various colleges. In this way, those with low ability tend to discontinue their education after high school graduation, or to select colleges requiring less ability. Unfortunately, however, the ability to succeed in college is not always the main criterion, but other influences such as family circumstances, maturation, interest, and many other factors affect the decision. The result of these influences is that many of our most able students fail to enroll in college, while many of the less able do enroll for a semester

[6] Millett. *op. cit.*, p. 178.

[7] George B. Smith. "Who Would Be Eliminated? A Study of Selective Admission to College." *Kansas Studies in Education,* 7 (December, 1956) 28.

or more. Iffert[8] reports that of the students who graduate in the upper half of their classes in the secondary schools in the United States, only about one-half go to college on a full-time basis, and only about three-fourths of these eventually receive a degree. Millett[9] states that of the upper twenty-five per cent of our young people in terms of intellectual achievement, over one-half do not now go to college. Conversely, over one-half of all young people who do go to college are below this level of intellectual achievement. It is apparent, then, that certain natural selective processes are in operation, based on the extent of motivation, financial resources, and discriminatory barriers. It is also apparent that these natural processes are not necessarily operating in the best interests of the individual student or the nation as a whole.

Among those who do enroll in a college or university, a further selective process seems to operate. Studies reveal that of those students enrolling as college freshmen, only about 40 per cent will graduate from the original institution within four years, and a total of only 60 per cent will ever graduate from that or any other institution of higher learning. Other studies show that of those who fail to receive the degree, a fairly large percentage possess above average intellectual ability and have a good college record at the time of withdrawal.

Statement of Purpose

The present study[10] was one of a series of studies being planned, or already accomplished, dealing with the freshman class which entered The University of Kansas in the Fall of 1954.[11]

The present investigation was a study of the relationships between grade-point averages, placement-test scores, semester hours earned, and area of major interest of the students.

Specifically, the purpose may be stated as a study of the relationships between the following factors:

1. Intellectual ability as determined by the commonly used placement examinations.

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[8] Robert E. Iffert. *Retention and Withdrawal of College Students,* Bulletin 1958, No. 1, U. S. Office of Education, Washington, D.C., 1957.

[9] Millett. *op. cit.,* p. 176.

[10] E. L. Barnhart. Unpublished dissertation submitted to the Department of Education and to the Faculty of the Graduate School of The University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Education May, 1959.

[11] Kenneth E. Anderson. University of Kansas: General Research Project Number 3248-5038.

2. Success in college, as measured by over-all grade-point averages.
3. Persistence in college, in terms of the number of credit-hours accumulated to the time of withdrawal or interruption.
4. Differences in these relationships in the various schools of higher education, that is, the student's major area of activity.

Data developed in connection with studies of these relationships should be of considerable value in determining a course of action for an individual college or university in connection with admissions policies and, equally important, it should guide more able students into college and to the successful completion of a college program.

PART II

Sources of Data and Procedures Employed

Description of the Study Group

Placement-test scores were available for 1233 individuals who enrolled as freshmen at The University of Kansas in September, 1954. Of these, 13 test records were incomplete, leaving 1220 complete records. For the purposes of the present study, 115 students who interrupted their registration for a semester or more, and then re-enrolled, were eliminated from consideration.

The Placement Tests Used

Eight placement-test scores were available for each of the individuals included in the study. The scores for each student were recorded on I.B.M. cards in the form of gross or raw scores, as well as in sten scores. The raw scores were used in this study. The scores were obtained from four placement examinations administered to the group under study at the time of their first enrollment at The University of Kansas in September, 1954. The examinations were:

1. *American Council on Education Psychological Examination.* The total score is known as the "T" score, and the two sub-scores are known as the "L" or linguistic, and the "Q" or quantitative scores.

2. *The American Council on Education Cooperative English Test, Test C2: Reading Comprehension, Form Y.* This test consists of two parts, vocabulary and reading. The reading section provides separate scores for speed and level of comprehension. The latter section is not scored at The University of Kansas; hence, only the vocabulary and speed scores were used in this study.

3. *The Educational Testing Service Cooperative English Test, Form OM,* provides scores for usage, spelling, and vocabulary. Since the *American Council on Education Cooperative English Test* measures vocabulary, only the scores on usage and spelling were used in this investigation.

4. *The University of Kansas Mathematics Test for Entering Students, Form D-47,* is a revision of an earlier form to adapt it to machine scoring. Only one score is available from the test.

Throughout the remainder of this study, the following abbreviations will be used to refer to the eight placement-test scores: ACE-Q, ACE-L, ACE-T, CRT-V, CRT-S, CET-U, CET-S, and KU-M. These abbreviations correspond, in order, to the separate scores on the four tests just described.

Grade-Point Averages

This study was begun in late 1957, only three years after the initial enrollment of the study group; consequently, only six semesters of work, plus possible summer work, were recorded in the Registrar's Office of The University of Kansas at that time. Photostatic copies of the transcripts for the 1247 students who enrolled as freshmen in September, 1954, were obtained, and work on the calculation of grade-point averages was begun. When the seventh and eighth semesters were completed, supplementary data were obtained from the Registrar's Office in the form of an hour-point summary. This summary listed the names of all students enrolled on the Lawrence Campus of the University, together with a listing of total semester hours attempted, hours of A, B, C, D, and F, and grade-point averages for the hours attempted. These lists were first checked against the original set of transcripts, and the names of those students who had dropped out during the eight semesters covered by the transcripts and the hour-point summaries, and had returned by the final semester, were eliminated from the study. It was also necessary to check records from the University Medical Center as well as records of off-campus programs to identify the individuals who had transferred to off-campus programs in nursing, occupational therapy, physical therapy, and medical technology. These individuals' names did not appear on the hour-point summary and would have thus been erroneously classed as having dropped out of the University if this step had not been taken.

After the incomplete records, and those of students who had dropped out and later returned, were eliminated, grade-point averages were computed for each of the 1105 students remaining in the study. These averages were based upon the total number of courses in which grades were received up to the time of the conclusion of the collection of data for the study, in June, 1958. As previously stated, individuals who interrupted their enrollment at The University of Kansas for one or more semesters were omitted from the study. Credits obtained by correspondence and courses completed during summer sessions at The University of Kansas or other universities or colleges were included in determining grade-point averages. Courses in which low grades were obtained and then repeated at a later date were counted each time a grade was received. Incomplete grades were not counted unless a final grade had been recorded. Military credits were not included in the study, since no grades were recorded.

A special method of computing grade points was adopted for the purposes of the research project. This method eliminated negative grade points, and thus simplified the handling of data. It will be observed from an examination of Table 2 that conversion of grade points from the usual University of Kansas scale to the research project scale involves the addition of a constant value of 1 to the former.

TABLE 2

Comparison of Grade-Point Values in The University of Kansas Records and in the Research Project

Letter Grades	Grade-point Values	
	University Records	Research Project
A	3	4
B	2	3
C	1	2
D	0	1
F	—1	0

The example in Table 3 will illustrate the method of calculating grade points. The grade-point average was obtained from the division of the total grade points by the total semester hours credit earned. For the example given, the grade-point average is equal to 25 divided by 15, which is equal to 1.67.

TABLE 3

Method of Calculating Grade Points

Course Number	Semester Hours	Course Grade	Grade Points Per Hour	Grade Points For Course
1	2	F	0	0
2	3	C	2	6
3	3	D	1	3
4	5	C	2	10
5	2	B	3	6
Total	15			25

STAY IN COLLEGE

During the early stages of the planning of this study, it was thought that the number of semesters of consecutive enrollment of a student could be used as an index of stay, or persistence, in college, thus dividing the 1105 students into eight groups. It soon became evident that this method would confuse the results of the study.

Since it was found that the typical student attended only during regular semesters, and did not transfer credit, and that graduation from certain of the schools within eight semesters would require the maximum enrollment,

it was decided to use the maximum allowable enrollment figure to determine the division points. The resulting grouping, shown in Table 4, was used in this study as an index of persistence in college.

TABLE 4

Groupings Used in This Study to Rank Drop-Outs as to Persistence in College

Group Number	Semester Hours Completed
1	0 - 17
2	18 - 34
3	35 - 51
4	52 - 68
5	69 - 86
6	87 - 104
7	105 - 122
8	123 and over

All students who dropped out of college and did not return during the period covered by the study were classified in one of the persistence groups. All others, who had either graduated by the close of the study, or had enrolled for eight consecutive semesters, were classified in another group.

CLASSIFICATION BY MAJOR

One of the purposes of this study was to determine what differences, if any, existed in the relationship of placement-test scores, grade-point averages, and stay in school among the various schools of the University. A student at The University of Kansas may complete a Bachelor's degree in the College of Liberals Arts and Sciences, the School of Business, the School of Education, the School of Engineering and Architecture, the School of Fine Arts, the School of Journalism, the School of Pharmacy, or in Nursing (in the School of Medicine). A fairly large proportion of students originally enroll in the College of Liberal Arts and Sciences, and later transfer to one of the Schools of the University; others transfer from one School to another, or from a School to the College. This posed a problem as to whether the comparison between schools should be made on the basis of the original enrollment, or by some later enrollment. While there are shortcomings in any action on this matter, it was decided to classify the students according to the School or College in which they were last enrolled at The University of Kansas.

STATISTICAL PROCEDURES

All of the purposes of this study involved determination of relationships; consequently, the statistical procedures used in the study were measures of

correlation, and tests of the significance of these correlations and of differences in means.

The Pearson product-moment coefficient of correlation was calculated to determine the relationship of grade-point averages to entrance-test scores, for one-hundred groups of students classified according to stay in school and major interest.

The Pearson product-moment coefficient of correlation is applicable only when the assumptions of linearity of regression and homoscedasticity are met. The correlation coefficient could not be used in this study to determine the relationship between stay in school and entrance-test scores, because the distribution of drop-outs was heavily skewed, with a large number of students failing to enroll for the third semester of college. This was found to be true for every interval of the distribution of entrance-test scores. It was therefore necessary to use one of the special measures of relationship, the coefficient of contingency, designated by the letter C.

The F-test was used in this study in connection with the t-test, and also as a part of the analysis of variance procedure.

The t-test is based upon the assumption of random sampling from a normally distributed population. Therefore, a significant difference in means as shown by the t-test might be the result of a true difference in means, or it might be the result of unequal variances. The variances were tested for homogeneity by means of the F-test. The F-ratio was determined by dividing the larger variance by the smaller variance. Since the variance ratio is a two-tailed test, the one and five per cent points in the F-table were interpreted as the two and ten per cent levels of significance. The five per cent level of significance was determined by interpolation. In all instances where the F-ratio of the variances of the two samples was found to be less than the value significant at the five per cent level, it was assumed that a significant t-value indicated a significant difference in means.

The F-ratio was also used in the analysis of variance technique. In this instance it was used to establish whether or not there was a significant difference in means. The F-ratio was:

$$F = \frac{\text{Between Mean Square}}{\text{Within Mean Square}}$$

The t-test was used to test the significance of the difference between the mean placement-test scores earned by the students who remained in the University for the eight semesters, or until they graduated, and those earned by the students who withdrew after completing 104 semester hours of courses, or less.

In all instances where significant differences in variances were found, by means of the F-test, the t-test was rejected as inappropriate for comparison

of the means. The Cochran-Cox method described by Johnson[12] was used in all such cases, since it required no assumptions regarding the variances, and was applicable to samples having different values of N.

The technique of analysis of variance was used in this study as a means of determining the significance of the differences in mean placement-test scores among students enrolled in the various Schools of the University.

When a value of F was found to be less than the table value at the five per cent level, it was concluded that the mean differences in achievement of the students in the various Schools were not significant. When a significant F was produced, it was necessary to establish homogeneity of variance. Bartlett's[13] test was chosen as appropriate for this purpose. When the F was significant, and the variances homogeneous, it was then necessary to compare achievement in the various schools by use of the t-test. The number of t-tests required for each analysis of variance problem was equal to:

$$\frac{N\ (N-1)}{2}$$

where N equals the number of schools or groups to be compared. This required six t-tests for each analysis of variance in this study.

It was also necessary to raise the probability levels from the usual values of one in 100 (one per cent level) or five in 100 (five per cent level), to one in 6(100) or 1.66 in 1000, and five in 6(100) or 8.33 in 1000.

PART III

The Research Outcomes

Analysis of the Study Group

The original group of entering freshmen who enrolled for the first time at The University of Kansas in September, 1954, numbered 1247. At the time this study was begun, placement-test scores were available on IBM cards for 1233 of these individuals. The test records on these cards were incomplete for 13 students, leaving a balance of 1220 records to be considered. Examination of the Registrar's records showed that of the 1220 individuals for whom complete records were available, 115 interrupted their enrollment at The University of Kansas for one or more regular semesters and then returned for one or more semesters. These individuals were eliminated from the study; the remaining 1105 students were the subjects of this study.

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[12] Palmer O. Johnson. *Statistical Methods in Research*. Prentice-Hall, New York, 1949, p. 75.

[13] *Ibid.*, pp. 83-85.

The records for the 1105 students were separated into two groups. One group of 549 students consisted of those who dropped out of the University and did not return during the period covered by the study; the other group, 556 students, were enrolled for course work during each of the eight semesters under consideration, or were graduated from The University of Kansas before the close of the study. Thus, we find that of the 1220 students for whom test records were complete, 45.6 per cent registered for eight consecutive semesters, or graduated before the end of the study; 45 per cent dropped out before completion of eight consecutive semesters and did not return during the period of the study; and 9.4 per cent failed to enroll for one or more semesters, but did enroll again before the study was completed.

Distribution of the Drop-Outs

The records of the 549 students who dropped out and did not return during the period under study were separated into eight groups to represent degrees of persistence in college, according to the plan described in Part II. Each of these eight groups was again divided into eight sub-groups, according to the School or College in which the students were registered at the time of their final enrollment. The results of this classification procedure are shown in Table 5.

Table 5

Hours Earned and Major at Time of Withdrawal of 549 Students Who Did Not Return

Hours	Majors*								
Earned	AS	BU	Ed	En	FA	Jo	Ph	NU	Totals
0- 17	46		4	17	11		1		79
18- 34	145		14	26	25		1		211
35- 51	47		1	14	4				66
42- 68	57		4	15	16		2	1	95
69- 86	12	1	5	6	2	1	1		28
87-104	25	1	10	7	3	1	1	3	51
105-122	6	1	7	2	1				17
123-and over	1	1							2
Totals	339	4	45	87	62	2	6	4	549

* The symbols used in this and subsequent tables are interpreted as follows:

AS—College of Liberal Arts and Sciences
Bu—School of Business
Ed—School of Education
En—School of Engineering and Architecture
FA—School of Fine Arts
Jo—School of Journalism
Ph—School of Pharmacy
Nu—Nursing (School of Medicine)

It is interesting to note that the largest number of drop-outs, 211, occurred after completion of from 18 to 34 hours, or the equivalent of one year, or less, of college work. A total of 290, or 52.8 per cent, of the drop-outs occurred

among students who had completed 34 semester hours of college work, or less. An additional 161 students discontinued college after completing from 35 to 68 hours. This group, representing 27.5 per cent of the total, corresponds roughly to sophomore standing. The number of individuals who failed to enroll in additional work after completing from 69 to 104 hours, or after reaching junior or early senior standing, totaled 79, or 14.6 per cent of those who withdrew. Those who did not re-enroll after completing 104 hours totaled 19, which was 3.3 per cent of those who withdrew and did not return during the period under study. Thus a greater number of drop-outs occurred after the second semester than between the first and second semesters.

The majority of the students who dropped out of the University were enrolled in the College of Liberal Arts and Sciences at the time of their final enrollment. These cases numbered 339, or 61.7 per cent of the total number of students who failed to re-enroll. This is not surprising, since the majority of freshmen, the group in which drop-outs occur with greatest frequency, enroll in the College of Liberal Arts and Sciences. There was also some tendency for students who had encountered scholastic difficulty in one of the Schools of the University to transfer to the College for a semester or more before withdrawing. This may be the result of guidance procedures operative at the University, or may be a natural course of action taken by the typical student who has failed to achieve success in a highly specialized curriculum. It will also be observed that the proportion of the total number of withdrawals that occurred in the College of Liberal Arts and Sciences was inversely related to the number of hours earned at the time of withdrawal. This might be expected, as an increasing number of students transfer from the College to the various Schools.

Distribution of the Students Who Continued

The records of the 556 students who enrolled for eight consecutive semesters, or until graduation, were separated into groups according to the College, or School, or area of major concentration at the time of their final enrollment. Table 6 shows this distribution.

Nursing, occupational therapy, physical therapy, and medical technology programs are not conducted in separate schools but are the result of cooperative effort between the School of Medicine and one or more of the other Schools of the University. In Table 6, these groups are listed separately, and they have not been included in the computation of relationships between grade-point averages and placement-test scores, due to the fact that the study was restricted to semester hours of credit completed on the Lawrence campus of the University.

TABLE 6

School of Final Enrollment of 556 Students Who Completed Eight Consecutive Semesters or Graduated

School	No. of Students	School	No. of Students
Arts and Sciences	142	Pharmacy	11
Business	75	Nursing	17
Education	114	Occupational Therapy	9
Engineering and Architecture	137	Physical Therapy	7
Fine Arts	25	Medical Technology	2
Journalism	17	Grand Total	556

THE RELATIONSHIP OF PLACEMENT-TEST SCORES TO GRADE-POINT AVERAGES FOR THOSE WHO WITHDREW AND THOSE WHO CONTINUED

The general purpose of the study has previously been described as a study of the interrelationships between: (1) intellectual ability, as determined by the commonly used placement examinations; (2) success in college, as measured by over-all grade-point averages; (3) persistence in college, in terms of the number of credit-hours accumulated to the time of withdrawal or interruption; and (4) the differences in these relationships in the various Schools of the University, that is, in the students' major area of activity.

The product-moment correlation was used to determine the relation between placement-test scores and grade-point averages. Comparison of these correlations for the various persistence groups, and for the various Schools, will serve to some extent as an indication of the other relationships sought.

The correlations showing the relationship between placement-test scores and grade-point averages for the first six persistence groups in Table 5 are presented in Table 7. The seventh and eighth persistence groups were not included, due to the small values of N for these groups.

The significance of these correlation coefficients was determined by reference to Snedecor's table. It will be observed that, of the 48 coefficients, 43 were significant at the one per cent level, and one was significant at the five per cent level. The only non-significant coefficients were two for the ACE-Q and two for the KU-M test. As reported in Part II, both of these tests measure mathematical ability. The table also reveals that the correlations between grade-point averages and the scores on these examinations were consistently lower than for any of the other tests for all students who completed 35 semester hours or more of work. The correlations were among the lowest for the remainder of the students, that is, those who withdrew with 34 hours, or less, completed. It will also be observed that the CET-U scores and the

TABLE 7

Correlations Between Placement-Test Scores and Grade-Point Averages for 530 Drop-Outs, Distributed According to Hours Earned

Placement Test	Correlations, by Hours Earned					
	0-17	18-34	35-51	52-68	69-86	87-104
ACE-Q	.48	.39	.12*	.31	.29*	.28**
ACE-L	.58	.45	.48	.59	.69	.49
ACE-T	.59	.49	.42	.53	.68	.47
CRT-V	.42	.43	.39	.54	.54	.49
CRT-S	.49	.48	.52	.56	.71	.42
CET-U	.60	.53	.58	.56	.74	.56
CET-S	.46	.33	.35	.57	.65	.45
KU-M	.35	.36	—.03*	.33	.14*	.38
N=	79	211	66	94	28	51

All correlations in this table are significant at the one per cent level, except those marked, which are interpreted as follows:

* Not significant.

** Significant at the five per cent level.

ACE-L scores consistently yielded higher correlations with success in college, as indicated by grade-point averages, than did the remainder of the tests.

The significance attached to these correlation coefficients is based upon the assumptions of linearity of regression, and homoscedasticity, or equal scatter. No tests were made of these assumptions, but scatter diagrams were prepared for the 12 correlations based on the relationship of the ACE-Q scores and the ACE-L scores to grade-point averages. Since none of these diagrams showed any wide departure from the assumptions, it was believed that the data upon which the remaining 36 correlations were based also met these assumptions.

Product-moment correlations were calculated between scores on each of the placement tests and grade-point averages for the entire group of 530 students who withdrew from the University after completing 104 semester hours or less and did not return before the study was concluded. These eight correlations are shown in Table 8. As might be expected, all of the correlations were significant at the one per cent level, and the lowest were those involving the ACE-Q scores, and the KU-M scores; the highest were those for the ACE-L scores and the CET-U scores.

Scatter diagrams were prepared for the two correlations based on the relationship of the ACE-Q and ACE-L scores to grade-point averages for the total group. Again, inspection of the scatter diagrams showed that the basic assumptions of linearity of regression and homoscedasticity were fulfilled.

TABLE 8

Correlations Between Placement-Test Scores and Grade-Point Averages for 530 Drop-Outs Who Completed 104 Hours or Less

Placement Test	Correlation with Grade-point Average*
ACE-Q	.41
ACE-L	.57
ACE-T	.56
CRT-V	.47
CRT-S	.54
CET-U	.62
CET-S	.46
KU-M	.38

* All correlations were significant at the one per cent level.

The correlations showing the relationship between placement-test scores and grade-point averages for the College of Liberal Arts and Sciences, and the Schools of Business, Education, and Engineering and Architecture are shown in Table 9. The other groups shown in Table 6 were not included, due to the small values of N for these groups.

TABLE 9

Correlations Between Placement-Test Scores and Grade-Point Averages for 468 Students, Distributed According to the School in Which They Were Enrolled at Close of the Study

Placement Test	Correlations by College or School			
	AS	BU	ED	EN
ACE-Q	.35	.38	.42	.39
ACE-L	.62	.46	.42	.33
ACE-T	.58	.48	.49	.42
CRT-V	.51	.50	.41	.28
CRT-S	.53	.39	.49	.33
CET-U	.59	.33	.47	.36
CET-S	.48	.30	.38	.09*
KU-M	.17**	.20*	.36	.12*
N =	142	76	114	137

* All correlations in this table were significant at the one per cent level, except those marked with a single asterisk.

** Significant at the five per cent level.

Snedecor's table was again used to determine the level of significance of the correlation coefficients. Of the 32 coefficients, 29 were significant at the one per cent level; the remaining three were not found to be significant. Two of the three non-significant correlations involved the KU-M scores, and the correlations for this test were, with one exception, the lowest for each of the

Schools. Surprisingly, the correlation of these test scores with grade-point averages was lower for the School of Engineering and Architecture than for any of the remaining Schools. The correlations of the other measure of mathematical ability, the ACE-Q scores, were about equal for the four Schools. The six remaining tests correlated most highly with success in the College of Liberal Arts and Sciences. For the remaining Schools, none of the tests showed an outstanding correlation, although, as stated, all but three correlations were significant at the one per cent level. The CET-S score was unusually low in its correlation with success in the School of Engineering and Architecture, as compared with the other three Schools.

Scatter diagrams were again prepared as evidence of fulfillment of the assumptions underlying the product-moment coefficient. Eight such diagrams were prepared for the correlations based on the relationship of the ACE-Q and ACE-L scores to grade-point averages. None of these showed any conspicuous deviations from the assumptions; consequently, it was believed that the remaining 24 sets of data met these assumptions.

Product-moment correlations were computed between scores on each of the placement tests and grade-point averages for 521 students who stayed in school for the entire eight-semester period under study, or graduated before the conclusion of the study. These students were enrolled in the first seven Schools listed in Table 6, at the time the study was concluded.

The tests of mathematical ability showed the lowest correlations, and the correlations of the ACE-L scores and the CET-U scores, with grade-point average, were the highest, although these correlations were all significant at the one per cent level. The correlations were nearly the same for all of the tests except the KU-M. These eight correlations are shown in Table 10.

TABLE 10

Correlations Between Placement-Test Scores and Grade-Point Averages for 521 Students Who Did Not Withdraw

Placement Test	Correlation with Grade-Point Average*
ACE-Q	.30
ACE-L	.45
ACE-T	.44
CRT-V	.39
CRT-S	.42
CET-U	.47
CET-S	.35
KU-M	.12

* All correlations were found to be significant at the one per cent level.

Scatter diagrams were prepared for the correlations based on the relationship of the ACE-Q scores and the ACE-L scores to grade-point averages.

These scatter diagrams appeared to indicate that the assumptions of linearity of regression and homoscedasticity had been met. It was therefore assumed that this was also true of the data upon which the remaining correlations were based.

The Relationship of Stay in School to Placement-Test Scores

Inspection of Table 7, showing the correlations between placement-test scores and grade-point averages, distributed according to hours completed, reveals to some degree the interrelationship of stay in school to these factors. It appeared desirable to make a separate analysis of the data for the students who withdrew, to determine what relationship, if any, existed between persistence in college and placement-test scores.

Comparison of Mean Placement-Test Scores

Some indication of this relationship can be gained from inspection of the mean scores obtained on each of the placement tests by each of the persistence groups. This information is contained in Table 11. It will be observed that in the case of every placement test, the mean score tended to increase in direct proportion to the number of hours completed by the students before they dropped out of college. From inspection of the means, it would seem reasonable to conclude that students who rank high on the placement tests will tend to remain in college longer than will those with low placement-test scores.

Table 11

Mean Placement-Test Scores Distributed According to Stay in School for 530 Students Who Withdrew

	Mean Scores, by Hours Completed					
Placement Test	**0-17**	**18-34**	**35-51**	**52-68**	**69-86**	**87-104**
ACE-Q	40.87	40.50	42.39	44.44	44.54	50.41
ACE-L	57.72	57.88	59.02	64.49	67.43	69.08
ACE-T	98.68	98.43	102.02	108.92	111.96	119.49
CRT-V	26.03	27.23	27.73	30.60	34.29	31.18
CRT-S	20.03	22.87	22.88	27.99	30.29	32.24
CET-U	75.49	85.56	78.52	100.14	102.04	105.35
CET-S	12.95	16.29	13.53	18.86	21.64	19.22
KU-M	40.52	41.12	44.08	47.42	49.71	50.84

In Table 12, the mean score on each placement test for the 530 students who withdrew from college is compared with that achieved by 521 students who remained in one of seven Schools for the duration of the study, or graduated. The mean score on each placement test is higher for the group

TABLE 12

Comparison of Mean Placement-Test Scores for 530 Drop-Outs and 521 Students Who Remained in School

Placement Test	Mean Score		Variance Ratio	Significance	
	Withdrawn	Cont'd	F	t	P*
ACE-Q	42.66	49.09	1.14	8.74	.001
ACE-L	60.77	70.16	1.14	3.33	.001
ACE-T	103.54	119.40	1.21**	11.55	.001
CRT-V	28.47	33.49	1.10	7.49	.001
CRT-S	24.66	32.74	1.06	9.29	.001
CET-U	88.57	103.70	1.35**	8.59	.001
CET-S	19.48	19.90	1.01	1.71	.10
KU-M	43.92	53.02	1.46**	10.09	.001

* Degrees of Freedom $= n_1 + n_2 - 2 = 1049$.

** Significant at the two per cent level.

that remained in college to graduation, or to the completion of the study, than the group that withdrew during the study. Application of the t-test showed that the differences in means were significant at the .001 level for all except the CET-S, which was significant at the ten per cent level. The null hypothesis under test was: are these random samples from the same normal population? The t-test was appropriate for use here, providing that the entire sample of scores for each placement test was normal and the variances of the two groups, those who withdrew and those who continued, were homogeneous.

The assumption of normality was not tested, because Stucky,[14] who used the same data in a related study, reported skewness and kurtosis for each placement test for the entire group of students. His values for these statistics indicated some departure from normality in terms of skewness for some of the tests but very little departure from normality in terms of kurtosis for any of the tests. Fisher[15] has proven that for distributions that exhibit only a slight departure from normality, the efficiency of the t-test is not seriously affected; further, the N for each group involved in the comparison was in excess of 500.

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[14] Milo O. Stucky and Kenneth E. Anderson. "A Study in College Attendance in Relation to Placement-Test Scores and Grade-Point Averages." *Kansas Studies in Education,* 9 (April, 1959) 1-58.

[15] R. A. Fisher. "On the Mathematical Foundations of Theoretical Statistics." *Philosophical Transactions of the Royal Society of London,* A, 222 (1922) 309-368.

The assumption of homogeneity of variances was tested by use of the F-test described in Part II. In three instances, as shown in Table 12, the values of F were found to be significant at the .02 level. In these cases, the values and probabilities for t were computed by the use of the Cochran-Cox method, which is not based on the assumption of homogeneity of variances.

It was decided to use a correlation method to prove the existence or lack of existence of relationship between stay in college and placement-test scores for the six groups that withdrew from the University and did not return during the eight semesters under study. Examination of the data showed that the distribution of drop-outs was skewed with more than 50 per cent occurring by the end of the second semester. This precluded the use of the product-moment coefficient of correlation. The contingency coefficient was selected as appropriate for use, since it requires few assumptions, and is applicable to tables having several categories in each direction. The first step involved the arrangement of the data into tables in which the expected frequency in each cell would have a value of five or more. At the same time, it was desired to retain the six categories of persistence in college; the result of the attempt to meet these two requirements was a five by six table for each of the distributions.

Table 13 presents the contingency coefficients, chi-square values, and probabilities, uncorrected, and corrected for errors introduced by grouping. The contingency coefficients showed that a relationship existed between each of the placement tests and persistence in college. All of the coefficients were significant at the one per cent level. When corrections for grouping were made, however, it was found that only the ACE-T, CET-U, and KU-M scores produced contingency coefficients significant at the one per cent level; the ACE-Q was significant at the five per cent level.

TABLE 13

Uncorrected and Corrected Contingency Coefficients, Chi-Square's, and Probabilities for the Relationship Between Placement-Test Scores and Stay in College, for 530 Drop-Outs

Placement Test	Uncorrected			Corrected		
	C	X^2	P	C	X^2	P
ACE-Q	.31	54.59	.001	.25	34.45	.05
ACE-L	.28	45.79	.001	.21	25.65	.20
ACE-T	.32	60.69	.001	.27	40.55	.01
CRT-V	.29	49.03	.001	.23	28.89	.10
CRT-S	.29	46.69	.001	.22	26.55	.20
CET-U	.34	67.58	.001	.29	47.44	.001
CET-S	.27	42.40	.01	.20	22.26	.50
KU-M	.33	63.23	.001	.27	43.09	.01

The Relationship of Stay in School to Grade-Point Averages

One of the relationships to be studied, as enunciated in the general statement of the purpose of this study, was the relationship of stay in school to grade-point average. This was one of the factors involved in the correlations shown in Table 7; however, the extent of the influence of this factor and that of placement-test scores is not clearly ascertainable from that table.

Inspection of Table 14 discloses a rather consistent increase in the mean grade-point average associated with an increase in the number of hours completed before withdrawal.

Table 14

Mean Grade-Point Averages for 530 Students Distributed According to Hours Earned Before Dropping Out

Hours Earned	Grade-Point Average
0 - 17	1.37
18 - 34	1.65
35 - 51	1.61
52 - 68	2.26
69 - 86	2.17
87 - 104	2.34

Further evidence of this trend is shown in Table 15, where the mean grade-point average for the 530 students who withdrew is compared with that of the 521 who remained in The University of Kansas during all of the eight semesters, or until graduation. Application of the t-test showed that the difference in means was significant at the .001 level of probability.

Table 15

Comparison of Mean Grade-Point Averages for 530 Students Who Withdrew from the University and 521 Students Who Remained

Student Action	Grade-Point Average*
Withdrew	1.80
Continued	2.67

* Application of the Cochran-Cox test produced a t-value of 21.43. for the difference in means, which was found to be significant at the .001 level of probability. The Cochran-Cox test was used because the variance ratio was 2.47, which was significant at the .02 level.

Stucky[16] computed skewness and kurtosis for grade-point averages for this same group of students for each of the first five semesters. It was inferred from his data that the grade-point distributions in this study did not depart

[16] Milo O. Stucky. *op. cit.*, p. 12.

excessively from normality; hence, this assumption was not tested. The F-test was applied to determine the variance ratio, and it was found to be significant at the .02 level of probability. The Cochran-Cox test was then used to determine the significance of the difference in means since it requires no assumptions regarding the population variances. The difference in the mean grade-point averages of those who remained in school as compared with those who withdrew was found to be significant at the .001 level of probability.

As further evidence of the existence and extent of the relationship between grade-point average and continuance in college, the contingency coefficient was computed, using the procedure already described. The data for the calculations were arranged into a five by six table shown in Table 16.

TABLE 16

Contingency Table Showing Relationship Between Grade-Point Average and Stay in College

	Number of Students, by Grade-Point Average					
Hours Earned	00 to 1.19	1.20 to 1.59	1.60 to 2.09	2.10 to 2.59	2.60 to 3.79	Totals
87-104	1	4	17	11	18	51
69- 86	1	7	5	7	8	28
52- 68	4	14	23	25	29	95
35- 51	10	32	12	7	5	66
18- 34	66	39	48	33	25	211
0- 17	35	15	9	15	5	79
Totals	117	111	114	98	90	530

Table 17 shows the contingency coefficient, chi-square value, and probability for the data as given in Table 16, and corrected for grouping.

TABLE 17

Uncorrected and Corrected Contingency Coefficients, Chi-Square's, and Probabilities for the Relationship Between Grade-Point Averages and Stay in College, for 530 Drop-Outs

Uncorrected			Corrected		
C	Chi-square	P	C	Chi-square	P
.45	135.79	.001	.42	115.65	.001

In Table 17, with (r—1) (c—1), or 20 degrees of freedom, the values of chi-square exceed the tabled value at the .001 level before and after correction for grouping. It must be concluded, therefore, that there was a sig-

nificant relationship between grade-point averages and continuance in college. Inspection of Table 16 shows that this relationship is positive; in other words, the groups of students who remained in college longer tended to have higher grade-point averages.

Comparison of Placement-Test Scores Earned by Students Enrolled in Various Schools

The differences in the relationship between intellectual ability, success in college, and persistence in college existing in the various Schools of the University, were to be studied according to the general statement of the purpose of the study. Table 18 contains the mean scores attained on each of the placement tests by 521 students who remained in the University for the duration of the study distributed according to the School in which they were last enrolled. The N's were too low to permit the attachment of a great deal of significance to the means for the Schools of Fine Arts, Journalism, and Pharmacy, but they should be of some value and interest. For the three remaining Schools and the College of Liberal Arts and Sciences, they should serve as reasonably reliable indicators of the mean academic ability of the students enrolled in the various Schools, as measured by the placement tests used.

The discussion of Table 18 will be confined to a comparison of the mean placement-test scores earned by the students whose final enrollment was in one of the four schools in which N was large enough to permit reliable conclusions, namely: the College of Liberal Arts and Sciences, and the Schools of Business, Education, and Engineering and Architecture.

Inspection of Table 18 reveals some conspicuous differences in mean scores for the various placement tests among students enrolled in the various Schools of the University. The analysis of variance technique was applied to identify the differences that were statistically significant. The F-ratio of mean squares showed that significant differences existed among the schools for each of the placement tests. Subsequent application of Bartlett's test showed that the variances were homogeneous for all except the KU-M test, so the analysis of variance technique was considered to be an appropriate statistical tool for all of the other comparisons. In the case of the KU-M test, separate F-tests were applied to each comparison, and the Cochran-Cox t was computed. The assumption of normality was not tested, for the reasons previously discussed in connection with the t-test. In addition, in discussing the assumptions required for analysis of variance, Johnson says, "The population distribution should be normal. This assumption, however, is not especially important."[17]

[17] Johnson. *op. cit.*, p. 218.

TABLE 18

Mean Placement-Test Scores for 521 Students Who Remained in the University, Distributed According to School of Last Enrollment

Placement Test	Mean Scores by School						
	AS	BU	ED	EN	FA	JO	PH
ACE-Q	49.51	49.23	45.69	53.29	43.08	49.05	39.27
ACE-L	74.18	67.97	62.28	70.33	69.72	76.12	63.36
ACE-T	123.63	117.87	112.02	123.82	112.80	125.18	102.64
CRT-V	37.13	31.00	30.04	32.99	36.76	39.88	28.27
CRT-S	36.01	30.43	29.38	32.26	31.68	37.47	24.91
CET-U	107.92	98.23	108.72	100.04	98.08	110.00	83.09
CET-S	21.66	16.96	21.78	17.87	22.44	21.47	15.00
KU-M	52.73	54.17	46.79	59.13	46.88	50.47	55.18
N =	142	75	114	137	25	17	11

Legend: AS—College of Liberal Arts and Sciences
BU—School of Business
ED—School of Education
EN—School of Engineering and Architecture
FA—School of Fine Arts
JO—School of Journalism
PH—School of Pharmacy

The results of the application of the analysis of variance, and the Cochran-Cox test where applicable, are presented in Table 19. Tables 18 and 19 must be considered together in order to determine the significant differences as well as the direction of the differences.

It is interesting to note that the students in the School of Engineering and Architecture earned the highest mean score among the four Schools on both of the quantitative tests, that is, the ACE-Q and the KU-M. This is to be expected, since mathematical ability is one of the requisites for success in a School of Engineering. The lowest mean scores on the two tests were received by students in the School of Education. These differences were, in each case, found to be significant at the one per cent level, thus indicating that they were not random variations. Students in the School of Engineering and Architeceture also achieved higher scores, significant at the one per cent level, than students in the College of Liberal Arts and Sciences on both of these tests. At the five per cent level, students in the School of Engineering achieved significantly higher on the ACE-Q than did students in the School of Business and in the School of Education. On the KU-M test, the students in the School of Business and in the College of Liberal Arts and Sciences earned higher mean scores, at the one per cent level, than did students in the School of Education.

The students in the College of Liberal Arts and Sciences ranked highest of the four groups of students in mean scores on the ACE-L, CRT-V, and CRT-S, and very close to the top on the CET-U and CET-S scores. This is not surprising, since all five of these tests measure linguistic skills, which should be related to success in a liberal-arts curriculum. Somewhat startling, at first glance, however, is the fact that the students in the School of Education received the lowest mean score of the group on the ACE-L, CRT-V, and CRT-S, but ranked first on the CET-U and CET-S scores. The differences between the mean scores of the students in the College of Liberal Arts and Sciences and in the School of Education were not significant in the case of the latter two tests, but were significant at the one per cent level in the case of the first three tests. There is no obvious justification for the low ranking on the first three tests, as it would appear that a prospective teacher should possess superior linguistic skills; the high ranking on the latter two might be explained by the fact that the CET-U and CET-S tests have been criticized for what is described as an unnatural approach to the measurement of ability in spelling and usage. These tests tend to measure ability to identify incorrect spelling, and knowledge of the mechanics of usage, according to some critics. If these criticisms are justified, then it would follow that the disparity in mean scores on the CET, as opposed to the mean scores on the CRT and the ACE-L tests, would indicate that the students in the School of Education excel in knowledge of mechanics of English usage and in the identification of incorrect spelling, but are deficient in the more subtle linguistic abilities.

TABLE 19

Results of Analysis of Variance of Mean Differences in Placement-Test Scores Earned by Students in the Four Large Schools

Schools Compared	t-Values by Placement Tests							
	ACE-Q	ACE-L	ACE-T	CRT-V	CRT-S	CET-U	CET-S	KU-M
AS-BU	.19	3.09*	1.90	4.39**	2.77*	2.51	3.31**	.62
AS-ED	2.93*	6.69**	4.35**	5.53**	3.83**	.24	.15	3.19**
AS-EN	3.20**	2.29	.08	3.39**	2.12	2.47	3.19**	3.14**
BU-ED	2.40	3.03*	2.01	.63	.56	2.89*	3.09*	3.61**
BU-EN	3.04*	1.30	2.20	1.37	.89	.51	.63	2.05
ED-EN	6.32**	4.90**	4.85**	2.22	1.05	2.78*	2.98*	6.38**
F***	12.32	8.11	9.38	11.97	5.47	4.69	6.64	12.85
Chi-square	3.89	5.95	5.16	1.28	5.48	4.19	.47	16.49****

* Significant at .05 when the probability level is raised to 8.33 in 1,000 or a t value of 2.64.

** Significant at .01 when the probability level is raised to 1.66 in 1,000 or a t value of 3.14.

*** All mean square ratios were significant at the one per cent level.

**** Bartlett's test produced a value of chi-square significant at the one per cent level: therefore, the t-values for KU-M were computed by the Cochran-Cox method.

Students in the School of Business and in the School of Engineering and Architecture achieved significantly higher ACE-L scores than did those in the School of Education. The ACE-L mean score for the students in the College of Liberal Arts and Sciences was significantly higher, at the five per cent level, than that for the students in the School of Business. The CRT-V and CET-S mean scores were also significantly higher, at the one per cent level, for students in the College of Liberal Arts and Sciences than for students in the School of Business and in the School of Engineering and Architecture. The CRT-S and CET-S scores were significantly higher, at the one per cent level, for students in the College of Liberal Arts and Sciences, than for students in the School of Business.

The ACE-T score is the sum of the scores on the linguistic and quantitative sections of the examination. This score is assumed to be an index of over-all scholastic intelligence, because it measures the two major abilities required for success in a well-rounded college program. The students in the College of Liberal Arts and Sciences, and in the School of Engineering and Architecture, shared first place in mean total score on this test; the students in the School of Education ranked lowest of the four groups in this respect. These differences were both significant at the one per cent level.

Comparison of Grade-Point Averages Among Students Enrolled in Various Schools

The differences in the correlation of grade-point averages with placement-test scores for the various schools has been presented. The comparison of mean grade-point averages earned by students in the different schools is presented in Table 20. The 521 students are distributed among the College of Liberal Arts and Sciences and the six Schools of the University. As in the preceding section, the value of N is low for three of the Schools.

Table 20

Mean Grade-Point Averages Earned by 521 Students Who Remained in the University, Distributed According to the School of Last Enrollment

School	N	Mean Grade-Point Average
Arts and Sciences	142	2.76
Business	75	2.60
Education	114	2.79
Engineering and Architecture	137	2.54
Fine Arts	25	2.90
Journalism	17	2.43
Pharmacy	11	2.49
Total N =	521	

Table 21 presents the results of application of the analysis of variance technique to the data, and of the Cochran-Cox test, where the variances were found to be non-homogeneous. The mean grade-point average for students in the School of Education and in the College of Liberal Arts and Sciences were significantly higher, at the one per cent level, than for students in the School of Engineering and Architecture. The mean grade-point average for students in the School of Education was found to be significantly higher, at the five per cent level, than for students in the School of Business.

TABLE 21

Results of Analysis of Variance of Mean Differences in Grade-Point Averages Earned by Students in Four Schools

Schools Compared	Difference in Means	Variance Ratio		Significance of Difference	
		F*	P	t	P
AS-BU	.16			2.16	
AS-ED	.03			.58	
AS-EN	.22	1.05		3.38	.01
BU-ED	.19	1.45	.05	3.06**	.05
BU-EN	.06			.82	
ED-EN	.25	2.10	.01	4.39**	.01

Mean Square Ratio = 7.63***
Chi-square = 22.27****

* Homogeneity of variances was not tested when the t-ratio was not significant.
** The Cochran-Cox method was used to determine t when the F was significant.
*** The mean square ratio was significant at the five per cent level, indicating that significant differences in means or variances existed.
**** The value of chi-square obtained from Bartlett's test was significant, with three degrees of freedom, at the five per cent level, indicating lack of homogeneity of variances.

The range of mean grade-point averages for students in the seven Schools was slightly less than five-tenths of one grade point. If the ACE-T score is taken as an indication of over-all scholastic intelligence, it is interesting to note that although the students in the School of Journalism ranked highest in mean score on this test, their grade-point average was the lowest of the Schools studied. One of three conditions might account for this, namely: (1) the general scholastic intelligence measured by the examination may not correlate positively with the kind of ability required in journalism; (2) the grading system may be more severe in the School of Journalism than in the other Schools with which it is compared; or (3) the students in the School of Journalism may not be applying their intelligence effectively.

Inverse relationships existed between grade-point averages and scholastic intelligence in the cases of the Schools of Education and Fine Arts. Students in these two Schools ranked in the two top positions in grade-point averages,

while the students from only one School, Pharmacy, averaged lower on the ACE-T score.

Summary

Of the 1247 students who originally enrolled at The University of Kansas as Freshmen in September, 1954, a total of 1051 were included in this study. Of these, 521 remained in the University for the duration of the study period, or until graduation, and 530 withdrew and did not return. More than 52 per cent of these drop-outs occurred after the students had completed 34 semester hours, or less. Approximately 80 per cent of those who dropped out had completed 68 semester hours or less at the time of their separation from the University. More than 60 per cent of the drop-outs were from the College of Liberal Arts and Sciences.

At the close of the study the 521 students who remained in the University were enrolled as follows: College of Liberal Arts and Sciences, 142; School of Business, 75; School of Education, 114; School of Engineering and Architecture, 137; School of Fine Arts, 25; School of Journalism, 17; and School of Pharmacy, 11.

Product-moment correlations were computed between placement-test scores and grade-point averages. The results are summarized in Part IV.

The relationship of placement-test scores to stay in school was approached from two directions: (1) the mean scores on each placement test for the group that remained in college were compared with those for the students who dropped out, using the t-test; (2) the contingency coefficient was used to determine the relationship between hours earned at drop-out and placement-test scores. The results are summarized in Part IV.

The relationship of grade-point averages to stay in school was also compared by the two methods discussed in the preceding paragraph. These results, too, are summarized in Part IV.

The mean placement-test scores earned by students in the four largest Schools of the University were compared by means of analysis of variance. Grade-point averages for students in the four Schools were also compared by means of the analysis of variance technique. Part IV describes the results of these comparisons.

PART IV

Summary of the Findings

The Relationship of Placement-Test Scores to Grade-Point Averages

The following statements summarize the findings with reference to the correlation of placement-test scores and grade-point averages for the students

who withdrew from the University and did not return during the period under study:

1. Of 48 correlation coefficients computed, 43 were significant at the one per cent level, and one additional coefficient was significant at the five per cent level.
2. The correlations of the ACE-Q and the KU-M scores with grade-point averages were found to be non-significant for the groups that withdrew after completion of 35-51 hours, and 69-86 hours.
3. The correlations for the KU-M and the ACE-Q scores with grade-point averages were consistently lower than the correlations for the other tests for students who withdrew after completing 34 hours, or less.
4. The highest correlations were obtained between grade-point averages and the ACE-L and CET-U scores.
5. When the drop-outs were considered as a group, all correlations between placement-test scores and grade-point averages were found to be significant at the one per cent level.
6. For the entire group, the correlations between grade-point averages and the scores on the ACE-Q and the KU-M tests, while significant, were the lowest among the placement tests.
7. When the entire group was considered, the correlations between grade-point averages and the scores on the ACE-L, ACE-T, and CET-U were the highest among the placement tests.

The following statements summarize the findings regarding the correlation of placement-test scores and grade-point averages for the students who remained in school until they graduated or to the conclusion of the study:

1. Of the 32 correlations, 29 were found to be significant at the one per cent level, with the others being non-significant.
2. The correlations for the KU-M scores with grade-point averages were found to be non-significant for the students remaining in the School of Business and in the School of Engineering and Architecture. The correlations of the scores on this test with grade-point averages were the least significant of any of the correlations for the College of Liberal Arts and Sciences and for the School of Education.
3. If one disregards the ACE-Q and KU-M tests, the highest correlations between grade-point averages and the remaining placement-test scores were obtained for students who were in the College of Liberal Arts and Sciences at the conclusion of the study.
4. The correlation of the CET-S scores with grade-point averages was found to be non-significant for students enrolled in the School of Engineering and Architecture at the close of the study.
5. When the entire group of 521 students who remained in school was considered, all correlations between placement-test scores and grade-point averages were found to be significant.

6. When the entire group was considered, the correlations of grade-point averages with the ACE-L and CET-U scores were the highest of any of the correlations, and the correlations of grade-point averages with the ACE-Q and KU-M scores were the lowest. The correlation of the KU-M test scores with grade-point averages was conspicuously lower than for the other tests.

The Relationship of Stay in School to Placement-Test Scores

Comparison of mean placement-test scores for the students who withdrew from school with those who remained in school revealed the following:

1. There was a direct relationship between the mean scores earned on each of the placement tests and the number of semester hours earned before withdrawal.
2. When the mean placement-test scores for the group who withdrew were compared with those for the students who remained in school, they were found to be higher for the latter group in every instance. All differences were significant at the .001 level, except that for the CET-S score, which was significant at the ten per cent level.

When the contingency coefficient was used to compare the relationship of the placement-test scores to stay in college for each of the persistence groups, the following results were obtained:

1. The contingency coefficient calculated for the ACE-L scores and semester hours earned was significant at the five per cent level.
2. The contingency coefficients calculated for the ACE-T, CET-U, and KU-M scores and semester hours earned were significant at the one per cent level.

The Relationship of Stay in School to Grade-Point Averages

Comparison of mean grade-point average for the 530 students who withdrew from the University with that for 521 who remained, revealed that the grade-point average for the group that stayed in the University was .87 grade points higher than for the group that withdrew. This difference was significant at the .001 level.

When the coefficient of contingency was used to compare the relationship of grade-point average to stay in college, for each of the persistence groups, the relationship was found to be positive and significant at the .001 level.

Comparison of Placement-Test Scores Earned by Students in the Various Schools

In the four Schools where the number of students who continued in the University totaled 75 or more for each School, the following observations were made concerning placement-test scores:

1. ACE-Q scores for students in the School of Engineering and Architecture were significantly higher, at the one per cent level, than for students in the School of Education and in the College of Liberal Arts and Sciences.
2. The mean scores on the ACE-Q test were higher, at the five per cent level of significance, for students in the College of Liberal Arts and Sciences and in the School of Business, than in the School of Education.
3. Students in the College of Liberal Arts and Sciences, School of Business, and School of Engineering and Architecture, earned mean scores on the KU-M test which were significantly higher, at the one per cent level, than those earned by students in the School of Education.
4. The mean score on the KU-M test earned by students in the School of Engineering and Architecture was significantly higher, at the five per cent level, than that earned by the students in the College of Liberal Arts and Sciences.
5. Students in the College of Liberal Arts and Sciences and in the School of Engineering and Architecture scored significantly higher, at the one per cent level, on the ACE-L test than did the students in the School of Education.
6. ACE-L scores were higher, at the five per cent level of significance, for students in the College of Liberal Arts and Sciences than in the School of Business; the mean score on this test for the School of Business was significantly higher, at the five per cent level than for the School of Education.
7. The ACE-T scores were higher, at the one per cent level, for students in the College of Liberal Arts and Sciences and in the School of Engineering and Architecture, than in the School of Education.
8. Students in the College of Liberal Arts and Sciences achieved significantly higher CRT-V scores, at the one per cent level, than did the students in the School of Business, School of Education, and the School of Engineering and Architecture.
9. Students in the College of Liberal Arts and Sciences scored higher, at the one per cent level, on the CRT-S than did the students in the School of Business and in the School of Education.
10. Students in the School of Education scored higher, at the five per cent level, than did the students in the School of Business and in the School of Engineering and Architecture, on the CET-U test.
11. Students in the College of Liberal Arts and Sciences scored higher, at the one per cent level of significance, on the CET-S test than did the students in the School of Business and in the School of Engineering and Architecture.
12. CET-S scores for students in the School of Education were significantly higher, at the five per cent level, than for the students in the School of Business and in the School of Engineering and Architecture.

PART V

Implications

This study has been designed as descriptive, rather than as predictive, research. Therefore, the presentation of the data has been in the form of a description of the characteristics of the study group, with no attempt to produce a formula that might be used to predict the success or failure of an individual student on the basis of his placement-test scores. A review of the literature has shown this to be somewhat futile, if one is concerned with individual prediction. If the concern is with the over-all efficiency of the educational institution, in the manner of a time and motion study or a cost analysis of an industrial or business concern, then prediction devices become useful. If the democratic ideal of the greatest good for the greatest number, along with concern for the worth of the individual, is taken as the basis upon which higher education is organized, then no attempt should be made, with existing measures of scholastic ability, to use selective admission procedures. This is, of course, strictly an academic question in the case of The University of Kansas, under existing statutes. Financial pressures on the Kansas State Legislature may, however, bring about the necessity of defense of the present policy of open admission.

On the basis of the findings of the present study, as well as of others discussed in the review of literature, it would appear that the placement-test scores are of general value in counseling individuals. The correlations and comparisons of mean placement-test scores reported in this study show definite over-all relationships that are important; yet, examination of the individual records and the scatter diagrams reveals many cases of under-achievement, as well as many cases in which students with low placement-test scores earned higher grade-point averages.

In this connection, it would appear that the KU-M test is of limited value in counseling students. The relationship between grade-point averages and the scores on this test were of little or no significance for any of the groups. Although the coefficient of contingency for the relationship of the scores on this test to length of stay in school was significant for the students who withdrew, it is difficult to interpret this for guidance purposes. Likewise, the disparity in the scores of the Pharmacy students on the KU-M test and on the ACE-Q test was difficult to interpret.

The CET-S score also appears to have limited usefulness. While the correlations between scores on this test and grade-point averages were reasonably high, the difference between scores for those who remained in school and for those who withdrew was only significant at the ten per cent level. The only inference that may be drawn from the data on this test was that spelling ability is of relatively little importance to success in the School of Engineering and Architecture.

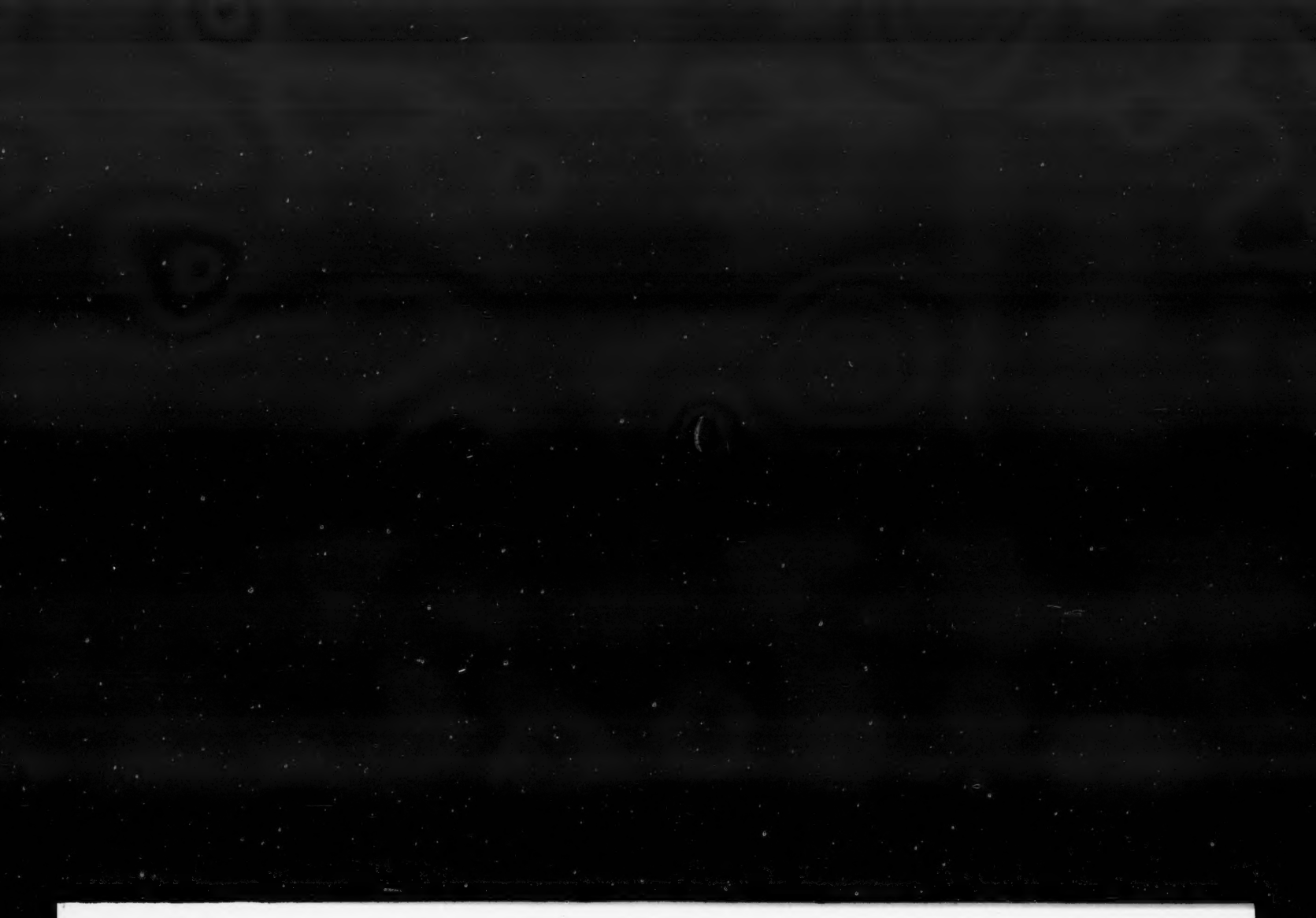
An important implication that can be drawn from this study is that many students who possessed sufficient ability to continue in the University were allowed to withdraw. More than one-third of the students who withdrew and did not return during the period of the study were maintaining a grade average of C or better. Among those who withdrew after completing 68 or more hours of courses, more than one-half were maintaining at least a C average. A follow-up of these individuals might well be the subject of another study in the hope that this attrition might be reduced or eliminated.

A frequently expressed opinion is that the students who prepare for, and enter, the teaching profession are inferior, academically, to those entering other branches of college or university training. The distribution of mean scores on the various placement tests would appear to confirm this opinion, at least for the group of students included in this study. Yet, the grade-point requirement for graduation from the School of Education is higher than for any other School of the University. Further, the grade-point average achieved by students in the School of Education was significantly higher, at the one per cent level, than that achieved by students in the School of Engineering and Architecture, although the latter group scored significantly higher than the former, on all except two of the eight placement tests. Similarly, students in the School of Education received a higher grade-point average, significant at the five per cent level, than students in the School of Business, although each exceeded the other on two placement tests, at a significant level. In other words, students in the School of Education and in the School of Business appeared to rank at about the same level on the placement tests, on the average, and yet the students in the School of Education excelled in terms of grade-point average. It might be erroneously assumed that it is easier to earn a high grade-point average in the School of Education than in the other Schools; however, it must be remembered that approximately 80 to 85 per cent of the semester hours earned by a typical student in the School of Education are completed in the College of Liberal Arts and Sciences and in other Schools of the University. In other words, a large proportion of the grade-point average for these students is based on course grades earned in competition with students from the University at large. Also, a student may not enter the School of Education until the junior year and he must present, for admission, a grade-point average equal to C. Students majoring in physical education may enter the School of Education as freshmen. Also, all students must present an over-all grade-point average of 1.1 and a grade-point average of 1.5 in his academic teaching major for graduation. These requirements tend to force or hold the mean grade-point average for students in the School of Education at a high level. Perhaps these students, as a group, are being stretched to higher levels of achievement in relationship to ability than any other group in the University or are motivated to do well in the academic areas in which they will teach.

It must be pointed out that about 80 per cent of those who enter the University of Kansas were in the upper half of their high school graduating

classes. Thus, those who enter the School of Education are superior in terms of this criterion. However, it is apparent that the placement tests did not provide an accurate measure of the ability of students to succeed in the School of Education. There is probably a complex of reasons underlying this anomaly. The importance of high scholastic ability for those who are preparing for teaching on the elementary or secondary level has never been clearly assessed. It is entirely probable that other characteristics, such as interest in helping others, and interest in people as opposed to interest in subject matter, may be of greater importance in this profession than mere scholastic ability. Certainly, the placement tests do not measure these kinds of ability; in fact, many studies have been made in an effort to identify the kinds of abilities characteristic of superior teachers, all without success. A search for the reasons underlying the lack of correlation between placement-test scores and grade-point averages in certain of the Schools of the University could well be the subject of another study.

These are only a few of the implications that may be drawn from the data in this investigation, and each of them could serve as the basis for one or more studies. It is hoped that the facts presented as the result of this research will make a worthwhile contribution to the picture produced by the larger research project of which it is a part. Considered by itself, two facts stand out clearly, namely: (1) selective admission cannot be safely practiced on the basis of test instruments currently used, and (2) the scores on the placement tests used in this study may be helpful in counseling students, provided that the limitations of this usage of the scores are clearly understood by both the counselor and the counselee.



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